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TURNOVER COST INDEX OF COMMERCIAL GOODS, IN CHINA

/Note: subsequently published errata are appended./

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The turnover cost index is one of the indexes which reflects the operation of state-owned trading enterprises. It enables the entrepreneur to compare his cost of turnover index for the current quarter with past quarters.

If $\bar{N}$ represents the average turnover cost index, and ES /$\bar{E}$ appearing in formulas represents summation sign/ represents the total cost of turnover, and EPQ represents the total of commercial goods sold where P represents the price and Q the quantity, then $\bar{N} = \frac{ES}{EPQ}$. (1)

The conditions that may cause $\bar{N}$ to change are (1) a change in value and (2) a change in the composition of commercial goods. The change in value takes two forms: (1) the change in value of commercial goods during transit and (2) change in value of the cost of turnover such as wages, packing material, and transportation facilities. $\bar{N}$ would be unrealistic if either the goods sold or the cost of turnover were affected by a change in value. Therefore, a base quarter with fixed price should be chosen for the calculation of $\bar{N}$.

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Table 1. 1951 - 1952 Turnover Cost Index of Commercial Goods for "X" Trading Company

Table	Actual Value 1951	Actual Value 1952	Price Index or Cost Index (1951 = 100)	Fixed Value 1951	Fixed Value 1952
Total turnover (100 million yuan)	500	600	99.5	500	603
Turnover cost (100 million yuan)	40	45	95.0	40	47
Turnover cost ratio (percent)	8	7.5	--	8	7.8
Comparative index table	100	93.75	--	100	97.5

Table 1 shows that the comparative index table based on current value is 6.25 percent lower where the 1952 index is 93.75 percent. This is directly shown by (1) a lower cost of turnover and (2) a change in the value of commercial goods and a change in the cost of turnover. In addition, the decrease in value of cost of turnover (the index being 95 percent), and the decrease in value of commercial goods (the index being 99.5 percent), necessarily exaggerate the decrease in the over-all turnover cost index. However, by adjusting the change in value to that of the base quarter, the table of comparative index becomes 97.5 percent, or is just 2.5 percent lower instead of 6.25 percent lower.

Other than by the change in value, the turnover cost index is also affected by a change in the composition of commercial goods. For example, the turnover cost index for the marketing of chinaware would be higher than the turnover cost index for the marketing of textile goods, since the packing and shipping of chinaware would require a higher cost, and their turnover is slower than that of textile goods. Also, the turnover cost index is higher in the rural communities than in the urban areas because of the difference in transportation facilities.

In addition to the above factors, there are still other conditions that affect the turnover cost index. If more goods of relatively higher turnover cost than goods of average turnover cost were sold, then the over-all turnover cost index would be higher, although the turnover cost for other goods had been reduced. Therefore, the table of comparative index is often misleading even after removing those factors arising from the change in value or from the change in the composition of commercial goods.

Table 2. Turnover Cost Index and Its Changes for "X" Trading Company (100 million yuan)

Commodity Classification	Total of Goods Turnover (fixed price)		Total of Turnover Cost (fixed price)		Turnover Cost Ratio		Turnover Cost Index, Unit
	Base Quarter	Current Quarter	Base Quarter	Current Quarter	Base Quarter	Current Quarter	
Symbol	P_oQ_o	P_oQ_1	S_o	S_1	N_o	N_1	$N_1 : N_o$
	1	2	3	4	5 (3:1)	6 (4:2)	7 (6:5)
A	500	1,000	40	63	8	6.3	.787
B	300	550	18	25.3	6	4.6	.77
C	150	150	6	4.8	4	3.2	.80
Total	950	1,700	64	93.1	--	--	--

The above table shows that the turnover cost index for all three commodities has been reduced by 20 percent or more. The turnover cost index for the base quarter is

$$\bar{N}_o = \frac{\Sigma S_o}{\Sigma P_o Q_o} = \frac{64}{950} = 0.06737 \text{ or } 6.737 \text{ percent.} \qquad (2)$$

The turnover cost index for the current quarter is

$$\bar{N}_1 = \frac{\Sigma S_1}{\Sigma P_o Q_1} = \frac{93.1}{1,700} = 0.05477 \text{ or } 5.477 \text{ percent.} \qquad (3)$$

The comparative change for the current quarter is the ratio between $\bar{N}_o$ and $\bar{N}_1$ or

$$\frac{\bar{N}_1}{\bar{N}_o} = \frac{0.05477}{0.06737} = 0.8129 \text{ or } 81.29 \text{ percent.} \qquad (4)$$

This computation shows that the over-all turnover cost index for the current quarter has been reduced by 18.71 percent (100 percent minus 81.29 percent).

Further analysis of the above shows that $\bar{N}_o$ minus $\bar{N}_1$ equals 0.06737 minus 0.05477 equals 0.0126 or 1.26 percent.

This computation shows that it cost 1.26 yuan less to sell 100.00 yuan worth of goods during the current quarter as compared with the base quarter.

Using the formula

$$(\bar{N}_o \text{ minus } \bar{N}_1) \Sigma P_o Q_1 \qquad (5)$$

the result is 0.0126 x 1.7 trillion yuan equals 21.42 trillion yuan. This computation shows that the lower cost of turnover during the current quarter has effected a saving of 21.42 trillion yuan.

Substituting in the formula

$$(EP_0Q_1 \text{ minus } EP_0Q_0)\ \bar{N}_0 \qquad (6)$$

we get (1700 - 950) x 0.06737 equals 50.52 trillion yuan. This shows that since more goods were sold during the current quarter, the turnover cost is higher. However, as a result of lower turnover cost during the current quarter, a saving of 21.24 trillion yuan was realized, so that actually the additional turnover cost was only 29.1 trillion yuan and not 50.52 trillion. This figure is obtained as follows: (50.52 minus 21.42) trillion yuan, or (93.1 minus 64) trillion yuan equals 29.1 trillion yuan. The turnover cost, then, is affected by the combination of (1) increased turnover of goods, which causes turnover cost to go up and (2) lower turnover cost index which causes turnover cost to go down. Thus the following formula can be used to calculate turnover cost:

$$ES_1 \text{ minus } ES_0 \text{ equals } (EP_0Q_1 \text{ minus } EP_0Q_0)\ \bar{N}_0 \text{ minus } (\bar{N}_0 \text{ minus } \bar{N}_1)\ EP_0Q_1 \qquad (7)$$

However, the above formula does not determine whether or not the turnover cost for each category of goods has been reduced, because the over-all decrease of turnover cost for all items (reduced by 18.71 percent with index of 81.29 percent) is less than the reduction in turnover cost of some categories. This shows that the turnover cost index is affected by a change in the composition of goods during the current quarter.

Probable comparative index equals fixed composition index times index affected by change in the composition of commercial goods. These three items form the index system. Thus the table of comparative index is calculated as follows:

$$\text{Comparative Index Formula: } \frac{ES_1}{EP_0Q_1} : \frac{ES_0}{EP_0Q_0} = \frac{EN_1 \cdot P_0Q_1}{EP_0Q_1} : \frac{EN_1 \cdot P_0Q_1}{EP_0Q_0} \qquad (8)$$

where N represents the turnover cost index of each category of goods.

$$\text{Therefore, } N_1 = \frac{S_1}{P_0Q_1} \text{ or, rewritten, } S_1 = N_1 \cdot P_0Q_1, \text{ so that} \qquad (9)$$

$$\underbrace{\frac{EN_1P_0Q_1}{EP_0Q_1} : \frac{EN_0 \cdot P_0Q_0}{EP_0Q_0}}_{\text{No 1}} = \frac{EN_1 \cdot P_0Q_1}{EN_0 \cdot P_0Q_0} : \frac{EP_0Q_1}{EP_0Q_0} = \underbrace{\frac{EN_1 \cdot P_0Q_1}{EN_0 \cdot P_0Q_0}}_{\text{No 2}} \times \underbrace{\left[\frac{EN_0 \cdot P_0Q_1}{EN_0 \cdot P_0Q_0} : \frac{EP_0Q_1}{EP_0Q_0}\right]}_{\text{No 3}} \qquad (10)$$

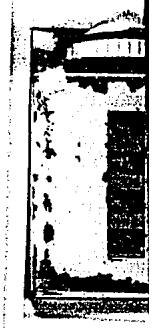
Here No 2 is the turnover cost index of commercial goods not affected by change in composition, and No 3 is the turnover cost index of commercial goods affected by a change in composition.

In No 2, $(EN_1 \cdot P_0Q_1)$ represents the sum total of turnover cost for the current quarter based on the base quarter index. The ratio of these two items is the rate of change. The difference between these two items is the amount of decrease in turnover cost index for each category of goods.

Again, from table 2:

$$\frac{EN_1 \cdot P_0Q_1}{EN_0 \cdot P_0Q_1} = \frac{63 + 25.3 + 4.8}{(1.80 \times 1{,}000) + (0.06 \times 550) + (0.04 \times 150)} \qquad (11)$$

$$= \frac{63 \times 25.3 - 4.8}{80 + 33 + 6.0} = \frac{93.1}{119} = 0.7823 \text{ or } 78.23 \text{ percent.}$$



Thus, the turnover cost index for the current quarter is actually reduced by 21.77 percent and not by 18.71 percent. The reduction is greater than 18.71 percent because previously the turnover cost index was still affected by the change in the composition of commercial goods.

Now ($\overline{EN}_o \cdot P_o\overline{Q}_1$ minus $EN_1 \cdot P_oQ_1$) trillion yuan = (119 minus 93.1) = 25.9 trillion yuan. Or, this may be rewritten as (17+7.7+1.2) trillion yuan; or (80 minus 63) + (33 minus 25.3) + (6.9 minus 4.8) trillion yuan, which is 25.9 trillion yuan. From this it can be determined which turnover cost has been reduced the least. However, in No 2 it can be noted that the probable comparative index shows a saving of 21.42 trillion yuan, which is 4.48 trillion yuan less as compared with 25.9. This is because more goods in classes A and B with higher turnover cost index were sold, that is, this is caused by the change in the composition of goods sold.

The following formula shows the relationship between a change in the composition of goods and the resulting turnover cost index.

$$\frac{EN_o \cdot P_oQ_1}{EN_o \cdot P_oQ_o} : \frac{EP_oQ_1}{EP_oQ_o}, \text{ or } \frac{EN \cdot \frac{P_oQ_1}{EP_oQ_1}}{EN \cdot \frac{P_oQ_o}{EP_oQ_o}}. \qquad (12)$$

Table 3. Calculation of Probable Comparative Index Chart

Commodity Classification	Goods Turnover (100 million dollars)		Change of Composition of Goods Turnover		Turnover Cost Index Base Quarter (percent)	Turnover Cost per 100 Yuan Based on Base Quarter Turnover Cost Index (Yuan)	
	Base Quarter	Current Quarter	Base Quarter	Current Quarter		Base Quarter	Current Quarter
	1	2	3	4	5	6(3x5)	7(5x4)
A	500	1,000	52.63	58.83	8	4.2104	4.7064
B	300	550	31.58	32.35	6	1.8948	1.9410
C	150	150	15.79	8.82	4	0.6316	0.3528
Total	950	1,700	100	100	--	6.7368	7.0002
Symbol	P_oQ_o	P_oQ_1	$\frac{P_oQ_o}{EP_oQ_1}$	$\frac{P_oQ_1}{EP_oQ_1}$	N_o	$N_o \frac{P_oQ_o}{EP_oQ_o}$	$N_1 \frac{P_oQ_1}{EP_oQ_1}$

In table 3 the turnover cost for the base quarter and the current quarter are provided in column 4.

The ratio between the two quarters is as follows:

$$\frac{N_1}{N_o} = \frac{7.0002}{6.7368} = 1.0391 \text{ or } 103.91 \text{ percent.}$$

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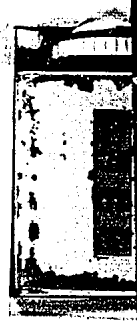

This shows that as a result of change in the composition of commercial goods during the current quarter, the turnover cost index has gone up by 3.91 percent.

The following shows the validity of the index equation:

$$0.8129 = 0.7823 \times 1.0391.$$

Now (N_1 minus N_o) represents the additional turnover cost in percentage during the current quarter, or (7.0002 minus 6.7368) equals 0.2634 yuan. This represents the additional cost of sales as a result of the change in the composition of goods sold. Thus, the over-all increase in the turnover cost for the current quarter is computed as follows:

$$0.2634 \times \frac{1,700 \times 100,000,000}{100} = 448,000,000 \text{ yuan.}$$

Detailed analysis shows the following figures for the items listed: (+ represents increase, − represents decrease, and figures are in 100 million yuan):

1.	Turnover cost of current quarter based on base quarter	119.0
2.	Savings realized during current quarter	− 25.9
3.	Actual turnover cost during current quarter	93.1
4.	Actual turnover cost during base quarter	64.0
5.	Increase in turnover cost over base quarter	+ 29.1
A..	Additional turnover cost from higher volume	+ 50.52
B..	Savings realized from lower cost	− 21.42
a.	Saving from lower cost	− 25.90
b.	Additional cost from change in the composition of goods	+ 4.48

Items No 2 and No 5 are of particular significance. Item No 2 shows the saving realized by achieving lower turnover cost, and item No 5 shows the increase in turnover cost over the base quarter which also affects the nationwide turnover cost index.

ERRATA (Tientsin, Ta Kung Pao, 7 July 1953)

1. In formula 8, the numerator in the fraction $\frac{EN_1 \cdot P_o Q_1}{EP_o Q_o}$ should read $EN_1 \cdot P_o Q_o$

2. In formula 10, the denominator in the fraction $\frac{EN_1 \cdot P_o Q_1}{\underbrace{EN_o \cdot P_o Q_o}_{No\ 2}}$ should read $\frac{\underbrace{EN_o \cdot P_o Q_1}_{No\ 2}}{}$

3. All N should read n.

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